

**DETAILED ACTION**

***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/03/11 has been entered.

***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1,6,9-12 are rejected under 35 U.S.C 103(a) as being unpatentable over Toshiaki (Japanese patent publication JP10121913) in view of Seki (4015436) further in view of Khan et al. (reissued US patent number 33408).

In re claim 1, Toshiaki discloses a compressor system including:

Rotary liquefied natural gas boil-off compressor ,in figure 1,comprising at least two compression stages (22,24) in series , a gas passage (26) passing through the series of compression stages (22,24) ,the gas passage (26) extending through and being in heat exchange relationship with at least one cooling means (27) disposed between the

compression stages (22,24) , wherein the at least one cooling means (27) is a cryogenic cooling means (see abstract and paragraph [0006]).

Although In one of the embodiments shown in figure 2 Toshiaki discloses a valve 34 installed at the discharge side 32 of compressor 24 there is no teaching about the use of similar valve between the compressor stages. Toshiaki also fails to disclose a cryogenic cooling having direct cooling chamber means and also fails to teach a liquid separator in communication with an outlet of the cryogenic cooling means.

Seki in the field of LNG compressor application teach a **cryogenic cooling means (injection tube 6;figure 1)** having **valve means (7)** , for controlling flow of coolant into the cooling means in response to the inlet temperature, or a related parameter, of the **compression stage (1)** downstream of the cooling means to maintain inlet temperature at a temperature between chosen sub –ambient temperature limits, in **figure 1 ,abstract and column 2,lines 26-31 and column 2,lines 59-column 3,line 45**; the cryogenic cooling means comprises a direct cooling means, a **chamber (the chamber is the intersection of conduit 4 and 3)** in the direct cooling means, an **inlet (tube 4)** for the chamber for introduction of the cryogenic coolant to the chamber and an **outlet (which is upstream of the intersection point of 3 and 4 but just before compressor inlet)** for the chamber.

Khan et al teach an outlet of a **direct cooling means (74)** communicates with a **vessel (100)** adapted to **disengage particles** of liquid from the natural gas, the **vessel (100)** having an **outlet (102)** for natural gas communicating with **compression stage (86; figure 2;column 4,lines 43-45)**.

It would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify the cryogenic compressor system of Toshiaki by including a valve system before or after the cryogenic cooler but before a stage of a compressor as taught by Seki in order to regulate the flow rate of the coolant and automatically monitor or adjust the temperature of the working fluid.

It would have been obvious to one skilled in the art at the time the invention was made to have modified the modified compressor of Toshiaki by attaching a particle separator before the compressor inlet as taught by Khan et al. in order to prevent liquid or other solid particles from entering the compressor chamber and damage the compressor parts.

In re claim 6 Toshiaki as modified discloses the claimed invention except mentioning that there is a cryogenic cooling means intermediate each pair of successive compression stages. But the compressor of Toshiaki is a two stage compressor and therefore It would have been obvious to one having ordinary skill in the art at the time the invention was made to install a cryogenic cooling means (either direct or indirect type based on design choice) in between each pair of successive compressor stages (if there are more stages such as three or more) because it is a mere duplication and it has been held that mere duplication of the essential working parts of a device involves only routine skill in the art. *St. Regis Paper Co. v. Bemis Co.*, 193 USPQ 8. *Adding another r stage to already existing 2 stage compressor*

In re claim 9 Toshiaki as modified discloses the claimed invention:

Toshiaki discloses:

There is a **cryogenic cooling means (35)** downstream of the **final compression stage (35;figure 2)**.

In re claim 10 Toshiaki as modified discloses the claimed invention:

Seki discloses:

There is a **cryogenic cooling means (6)** upstream of the first compression stage , in figure 1.

It would have been obvious to one skilled in the art at the time the invention was made to include a cryogenic cooler upstream of the first stage of the compressor of Toshiaki as taught by Seki in order to lower the temperature of the incoming gas.

In re claim 11 Toshiaki as modified discloses the claimed invention since the claimed "compressor" does not specify which compressor stage and the heat exchangers disclosed by both Toshiaki and Seki can be considered as forced liquefied natural gas vaporizer.

In re claim 12 Toshiaki as modified discloses the claimed invention:

Seki discloses:

A **liquefied natural gas storage tank (2)** having an outlet for boiled-off natural gas communicating with a **compressor (1)** the cryogenic **cooling means (6)** in communication with the liquefied natural gas in the storage tank (2), in figure 2.

It would have been obvious to one skill in the art at the time the invention was made to have provided a storage tank in the modified compression apparatus of Toshiaki in order to store the liquefied gas and regulate the flow as needed.

4. Claim 7 is rejected under 35 U.S.C 103(a) as being unpatentable over Toshiaki (Japanese patent publication JP10121913) in view of Seki (4015436) further in view of Khan et al. (reissued US patent number 33408) and Swearingen (US patent number 3889485).

In re claim 7 Toshiaki as modified discloses the claimed invention except stating that the compression has three stages.

Swearingen teaches similar compression apparatus in which there are at least three compression stages (35, 12, 17) in sequence and in that there is at least one direct cryogenic cooling means (discharge from compressor 12 and flow line 10 from cryogenic cooler mix resulting heat exchange which is direct cooling means and then delivered to compressor 17 via line 17 in figure 3) and at least one indirect cryogenic cooling means (18), in figure 3.

It would have been obvious to one skill in the art at the time the invention was made to have added third stage in the modified compressor of Toshiaki as taught by Swearingen in order to increase the degree of compression.

***Response to Arguments***

5. Applicant's arguments with respect to claims 1-16 have been considered but are not persuasive.

In regards to amended claim 1 (which now includes the subject matter of canceled claims 3-5), applicants on page 3 paragraph 2 argued that there is no suggestion or motivation in Toshiaki or Seki to communicate with a vessel adapted to disengage particles of liquid from natural gas. Applicants argued that examiner failed to establish a prima facie case of obviousness and also exercised an improper hindsight. On page 5 Applicant categorically argued (without providing evidence) that the addition of Khan to the disclosure of Toshiaki and Seki would render the Toshaiaki reference inoperable as intended. Regarding the alternate rejections Applicants in pages 6-7 also argued on the same line of reasoning stated above (Examiner has canceled the alternate claim rejection in this office action therefore this argument is moot).

Responding to applicants' argument:

Applicant's arguments that the addition of Khan to the disclosure of Toshiaki and Seki would render the Toshaiaki reference inoperable as intended fail to comply with 37 CFR 1.111(b) because they amount to a general allegation. As pointed out Khan et al. teach an LPG recovery and compression apparatus in the same field of application to that of Toshiaki and Seki. In all the three references due to the inherent presence of liquid in the gas stream one skill in the art would recognize that a teaching of residual

liquid separation before the gas is compressed would be beneficial to the compressor since it minimizes compressor damage due to the fact that liquids are incompressible. That is what Khan et al. are teaching. Khan et al teach an outlet of a direct cooling means (74) communicating with a vessel (100) adapted to disengage particles of liquid from the natural gas, the vessel (100) having an outlet (102) for natural gas communicating with compression stage (86), in figure 2 and column 4, lines 43-45. Therefore a skill artisan immediately recognize the benefit of the particle separator of Khan et al. and add it to the compressor of Toshiaki and still the apparatus is operable. If applicant stills maintains the argument examiner advises to provide a clear evidence how the combination would be inoperable. Applicant's assertion that examiner's proposed modification is an improper hindsight is also not correct. Please also note that, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). Furthermore, please note that the supreme court in *KSR* affirmed that the a patent claim can be proved obvious merely by showing that the combination of elements was obvious to try and that the Federal Circuit had erred by overemphasizing "the risk of courts and patent examiners falling to prey to hindsight bias" and as a result applying rigid preventative rules that deny fact finders recourse to common sense (see MPEP 2141).

***Conclusion***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amene S. Bayou whose telephone number is 571-270-3214. The examiner can normally be reached on Monday-Thursday, 8:00 am-5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon Kramer can be reached on 571-272-7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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